A Survey for Infectious Hematopoietic Necrosis Virus in Adult Sockeye Salmon *(Oncorhynchus nerka)* in Great Central Lake, British Columbia

G. S. Traxler

Department of Fisheries and Oceans
Fisheries Research Branch
Pacific Biological Station
Nanaimo, British Columbia V9R 5K6

December 1983

Canadian Technical Report of Fisheries and Aquatic Sciences No. 1205

Canadian Technical Report of Fisheries and Aquatic Sciences

Technical reports contain scientific and technical information that contributes to existing knowledge but which is not normally appropriate for primary literature. Technical reports are directed primarily toward a worldwide audience and have an international distribution. No restriction is placed on subject matter and the series reflects the broad interests and policies of the Department of Fisheries and Oceans, namely, fisheries and aquatic sciences.

Technical reports may be cited as full publications. The correct citation appears above the abstract of each report. Each report is abstracted in *Aquatic Sciences and Fisheries Abstracts* and indexed in the Department's annual index to scientific and technical publications.

Numbers 1 456 in this series were issued as Technical Reports of the Fisheries Research Board of Canada. Numbers 457 714 were issued as Department of the Environment, Fisheries and Marine Service, Research and Development Directorate Technical Reports. Numbers 715 924 were issued as Department of Fisheries and the Environment, Fisheries and Marine Service Technical Reports. The current series name was changed with report number 925.

Technical reports are produced regionally but are numbered nationally. Requests for individual reports will be filled by the issuing establishment listed on the front cover and title page. Out-of-stock reports will be supplied for a fee by commercial agents.

Rapport technique canadien des sciences halieutiques et aquatiques

Les rapports techniques contiennent des renseignements scientifiques et techniques qui constituent une contribution aux connaissances actuelles, mais qui ne sont pas normalement appropriés pour la publication dans un journal scientifique. Les rapports techniques sont destinés essentiellement à un public international et ils sont distribués à cet échelon. Il n'y a aucune restriction quant au sujet; de fait, la série reflète la vaste gamme des intérêts et des politiques du ministère des Pêches et des Océans, c'est-à-dire les sciences halieutiques et aquatiques.

Les rapports techniques peuvent être cités comme des publications complètes. Le titre exact paraît au-dessus du résumé de chaque rapport. Les rapports techniques sont résumés dans la revue *Résumés des sciences aquatiques et halieutiques*, et ils sont classés dans l'index annual des publications scientifiques et techniques du Ministère.

Les numéros 1 à 456 de cette série ont été publiés à titre de rapports techniques de l'Office des recherches sur les pêcheries du Canada. Les numéros 457 à 714 sont parus à titre de rapports techniques de la Direction générale de la recherche et du développement, Service des pêches et de la mer, ministère de l'Environnement. Les numéros 715 à 924 ont été publiés à titre de rapports techniques du Service des pêches et de la mer, ministère des Pêches et de l'Environnement. Le nom actuel de la série a été établi lors de la parution du numéro 925.

Les rapports techniques sont produits à l'échelon régional, mais numérotés à l'échelon national. Les demandes de rapports seront satisfaites par l'établissement auteur dont le nom figure sur la couverture et la page du titre. Les rapports épuisés seront fournis contre rétribution par des agents commerciaux.

Canadian Technical Report of

Fisheries and Aquatic Sciences No. 1205

December 1983

A SURVEY FOR INFECTIOUS HEMATOPOIETIC NECROSIS VIRUS IN ADULT SOCKEYE SALMON (*Oncorhynchus nerka*) IN GREAT CENTRAL LAKE, BRITISH COLUMBIA

by

G. S. Traxler

Department of Fisheries and Oceans

Fisheries Research Branch

Pacific Biological Station

Nanaimo, British Columbia V9R 5K6

(c)Minister of Supply and Services Canada 1983

Cat. No. Fs 97-6/1205 ISSN 0706-6457

ABSTRACT

Traxler, G. S. 1983. A survey for infectious hematopoietic necrosis virus in adult sockeye salmon (Oncorhynchus nerka) in Great Central Lake, British Columbia. Can. Tech. Rep. Fish. Aquat. Sci. No. 1205: iii + 11 p.

The prevalence of infectious hematopoietic necrosis virus (IHNV) in a population of adult sockeye salmon, Oncorhynchus nerka, was studied over a five year period. Adult fish were monitored at different stages of maturation for the presence of IHNV.

No virus isolations were made from any fish in pre-spawning condition. The prevalence of IHNV in post-spawned fish and carcasses ranged from 59.4-95.8% over the five year sampling period. Examination of post-spawned fish is indicated for the maximum chance of detecting IHNV in sockeye salmon.

Key words: Infectious pancreatic necrosis virus, sockeye salmon (Oncorhynchus nerka), British Columbia

RÉSUMÉ

Traxler, G. S. 1983. A survey for infections hematopoietic necrosis virus in adult sockeye salmon (Oncorhynchus nerka) in Great Central Lake, British Columbia. Can. Tech. Rep. Fish. Aquat. Sci. No. 1205: iii + 11 p.

On a étudié pendant cinq ans la fréquence de la nécrose hématopoiétique infectieuse (NHI) dans une population de saumons sockeyes (Oncorhynchus nerka) adultes. La présence de la NHI a été vérifiée chez les poissons adultes à divers stades de maturation.

Le virus n'a été isolé chez aucun poisson n'ayant pas encore frayé. La fréquence de la NHI chez les poissons et les carcasses de poissons qui ont frayé a varié de 59,4 à 95,8% au cours de la période d'échantillonnage de cinq ans. L'examen des poissons qui ont frayé offre le maximum de chances de déceler la NHI chez les saumons sockeyes.

Mots-clés: nécrose hématopoiétique infectieuse, saumon sockeye (Oncorhynchus nerka), Colombie-Britannique

INTRODUCTION

The purpose of this study was to examine the prevalence of infectious hematopoietic necrosis virus (IHNV) in a natural population of sockeye salmon, Oncorhynchus nerka, in Great Central Lake. The virus is widely distributed in sockeye populations along the Pacific coast of North America (Amend and Wood 1972, Grischowsky and Amend 1976, Hoskins et al. 1976). Our knowledge of the prevelance of pathogens in natural populations of fish is limited. Earlier surveys indicated the prevalence of IHNV in wild populations may be cyclic (Guenther et al. 1959).

The prevalence of IHNV in Great Central Lake sockeye salmon was studied for the following reasons:

1. To obtain baseline information in case the epizootiology of IHNV changed due to the increased production of sockeye salmon by a lake enrichment program.
2. To determine if the prevalence of IHNV in a sockeye salmon population is associated with the maturation stage of the fish sampled.

This report documents the prevalence of IHNV, over a five year period, in adult sockeye salmon returning to Great Central Lake.

MATERIALS AND METHODS

SAMPLE COLLECTION

Great Central Lake on central Vancouver Island, British Columbia, supports a large natural sockeye salmon population. Adult sockeye begin returning to the lake in early July and spawning occurs during November. Kidney samples were removed from male and female fish at different stages of maturation. Each sample was kept separate and instruments were disinfected between samples to avoid cross contamination. Pre-mature fish were collected from a trap located at Site A (Fig. 1) as they entered the lake. In 1975, 38 of these fish were held at Robertson Creek Hatchery until they matured. Samples from post-spawned fish and carcasses were collected near Nine Mile Creek (Site B).

Pre-mature fish were trapped, killed, and transported to the laboratory within 4 h of collection. Upon arrival, kidney samples were removed from the fish and stored on ice. Kidney samples from post-spawned fish were removed in the field and transported to the laboratory on ice. The samples were stored at -85°C until analysis, usually within two months of

collection. Virus assay methods followed the procedure outlined in the Canadian Fish Health Protection Regulations: Manual of Compliance (Anon. 1977). Representative positive samples were confirmed as IHNV by serum neutralization.

RESULTS

Table 1 shows the dates of collection and the prevalence of IHNV for all fish sampled. IHNV was not isolated from any of the pre-mature fish captured at Site A during the 5 year sampling period. In 1975, the only year in which mature fish in spawning condition were sampled, the virus was detected in 25% of the 12 females but not in any of the 10 males. High percentages of fish were found positive for IHNV in post-spawned samples in each year (Fig. 2). There was no significant difference ($P>0.05$) between males and females in the prevalence of IHNV over the sampling period (Table 2).

DISCUSSION

Although IHNV has frequently been isolated from salmonid stocks, the effects of the virus upon natural populations are poorly understood. A natural outbreak of IHN occurred in sockeye salmon alevins at Chilko Lake in 1973 (Williams and Amend 1976). The disease outbreak followed an extremely high egg deposition year, and severely reduced egg to fry survival.

IHN virus is usually detected only at the beginning or end of the sockeye salmon life cycle, i.e., in early fry and mature adults. In the present study, the prevalence of IHNV in the kidneys of post-spawned adult sockeye varied from 59.4-95.8% over the 5-year sampling period. Additional years of study would have to be included to determine if any cyclical pattern exists. No attempt was made to relate fry survival to IHNV prevalence in the adults.

IHNV was not found in any pre-mature fish and only at low levels in mature adults. The increased prevalence in post-spawned fish indicates that for the maximum chance of detecting IHNV in routine surveys, samples should be taken from spent fish. Storage of frozen tissue samples for IHN virus assays should be avoided if possible as the virus is rapidly inactivated (Wertheimer and Winton 1982). As samples were stored frozen in this study for varying periods of time it is likely the prevalence is higher than reported.

In a study of sockeye salmon, Mulcahy et al. (1982) found increasing prevalence and higher virus titers with advancing maturation. In this study the prevalence of IHNV positive fish also increased with advanced maturation. This is due possibly to the reduced activity of the immune system of the

maturing fish thus allowing virus replication. However, the possibility of horizontal transmission being responsible for the increased prevalence cannot be ruled out.

The Great Central Lake watershed supplies a major chinook salmon (Oncorhynchus tshawytscha) hatchery located at Robertson Creek. Chinook salmon are susceptible to IHNV (Amend et al. 1973) but no documented outbreak of IHN has occurred in Robertson Creek chinook. The estimated adult sockeye salmon returns to Great Central Lake during the study years are as follows: 1975 (150,000), 1976 (100,000), 1977 (214,000), 1978 (114,000), 1979 (260,000) (J. Manzer, pers. comm.). In spite of the tremendous number of virus particles that must be shed into the Robertson Creek Hatchery water supply, IHN virus has apparently not caused mortalities in chinook salmon reared at the hatchery. Perhaps optimum conditions for horizontal transmission have not occurred, or chinook fry are not susceptible to the strain of IHN virus in the sockeye population, or the Robertson Creek hatchery chinook are resistant to IHN. However, the potential for IHN outbreaks at this facility should be recognized.

ACKNOWLEDGMENTS

I thank Karl Peterson for assistance in obtaining many of the samples; and Drs. G. Bell and L. Margolis for reviewing the manuscript.

REFERENCES

Amend, D. F., and J. W. Wood. 1972. Survey for infectious hematopoietic necrosis (IHN) virus in Washington salmon. Progressive Fish-Culturist 34, 143-147.

Amend, D. F., W. T. Yasutake, J. L. Fryer, K. S. Pilcher, and W. H. Wingfield. 1973. Infectious hematopoietic necrosis (IHN). In Symposium on the major communicable fish diseases in Europe and their control, p. 80-98. Eur. Inl. Fish. Advis. Comm. Tech. Pap. 17, Suppl. 2, FAO, Rome.

Anon. 1977. Fish health protection regulations: manual of compliance. Dept. Fish. Environ. Fish. Mar. Serv., Ottawa. Miscellaneous Special Publication No. 31.

Grischowsky, R. S., and D. F. Amend. 1976. Infectious hematopoietic necrosis virus: prevalence in certain Alaskan sockeye salmon, (Oncorhynchus nerka). J. Fish. Res. Board Can. 33, 186-188.

Guenther, R. W., S. W. Watson, and R. R. Rucker. 1959. Etiology of sockeye salmon "virus" disease. U.S. Fish and Wildlife Service, Special Scientific Report-Fisheries No. 296 10 p.

Hoskins, G. E., G. R. Bell, and T. P. T. Evelyn. 1976. The occurrence, distribution, and significance of infectious diseases and neoplasms observed in fish in the Pacific region up to the end of 1974. Fisheries and Marine Service Technical Report No. 609.

Mulcahy, D., J. Burke, R. Pascho, and C. K. Jenes. 1982. Pathogenesis of infectious hematopoietic necrosis virus in adult sockeye salmon (Oncorhynchus nerka). Can. J. Fish. Aquat. Sci. 39: 1144-1149.

Wertheimer, A. C., and J. R. Winton. 1982. Differences in susceptibility among three stocks of chinook salmon, Oncorhynchus tshawytscha, to two isolates of infectious hematopoietic necrosis virus. NOAA Technical Memorandum NMFS F/NWC-22.

Williams, I. V., and D. F. Amend. 1976. A natural epizootic of infectious hematopoietic necrosis in fry of sockeye salmon (Oncorhynchus nerka) at Chilko Lake, British Columbia. J. Fish. Res. Board Can. 33, 1564-1567.

Table 1. The collection dates, location, sex, maturation stage, numbers sampled, and percent positive for IHNV.

Date	Sex	Maturation Stage	Site Collected	Number Sampled	Number IHNV Positive	Percent Positive
1975						
July 3	M	pre	A	11	0	0
July 3	F	pre	A	15	0	0
July 18	M	pre	A	14	0	0
July 18	F	pre	A	7	0	0
July 22	M	pre	A	13	0	0
July 22	F	pre	A	10	0	0
Sept 11	M	pre	A	10	0	0
Oct 24	M	pre	A	6	0	0
Oct 24	F	pre	A	5	0	0
Nov 7	M	mature	A	10	0	0
Nov 7	F	mature	A	12	3	25
Nov 11	M	post	B	11	11	100
Nov 11	F	post	B	13	12	92.3
1976						
July 14	M	pre	A	20	0	0
July 14	F	pre	A	25	0	0
Oct 18	M	pre	A	11	0	0
Oct 18	F	pre	A	39	0	0
Nov 17	M	post	B	49	41	83.7
Nov 17	F	post	B	33	30	90.9
1977						
June 22	M	pre	A	23	0	0
June 22	F	pre	A	19	0	0
July 13	M	pre	A	21	0	0
July 13	F	pre	A	20	0	0
Sept 22	M	pre	A	31	0	0
Sept 22	F	pre	A	39	0	0
Nov 15	M	post	B	85	48	56.5
Nov 15	F	post	B	43	24	55.8
Nov 18	M	post	B	24	15	62.5
Nov 18	F	post	B	18	14	77.8
1978						
July 12	M	pre	A	33	0	0
July 12	F	pre	A	17	0	0
Aug 12	M	pre	A	37	0	0
Aug 12	F	pre	A	30	0	0
Sept 12	M	pre	A	9	0	0
Sept 12	F	pre	A	9	0	0
Nov 22	M	post	B	28	24	85.7
Nov 22	F	post	B	16	12	75.0
Dec 7	M	post	B	14	9	64.3
Dec 7	F	post	B	14	10	71.4

Table 1 (cont'd)

Date	Sex	Maturation Stage	Site Collected	Number Sampled	Number IHNV Positive	Percent Positive
1979						
July 3	M	pre	A	33	0	0
July 3	F	pre	A	30	0	0
July 31	M	pre	A	22	0	0
July 31	F	pre	A	23	0	0
Aug 22	M	pre	A	13	0	0
Nov 27	M	post	B	3	2	66.7
Nov 27	F	post	B	17	12	70.6
Dec 7	M	post	B	15	11	73.3
Dec 7	F	post	B	7	6	85.8

Table 2. Results of survey for IHNV in kidney samples of post-spawned sockeye salmon.

Year	Males	Females	Totals
1975	11/11(100%)*	12/13(92.3%)	23/24(95.8%)
1976	41/49(83.7%)	30/33(90.9%)	71/82(86.6%)
1977	63/109(57.8%)	38/61(62.3%)	101/170(59.4%)
1978	33/42(78.6%)	22/30(73.3%)	55/72(76.4%)
1979	13/18(72.2%)	8/24(75.0%)	31/42(73.8%)
Total	161/229(75±13.8%)**	120/161(78.8±11.4%)	281/390(78.4±12.3%)

* No. positive/no. examined (percent positive)
** Standard deviation

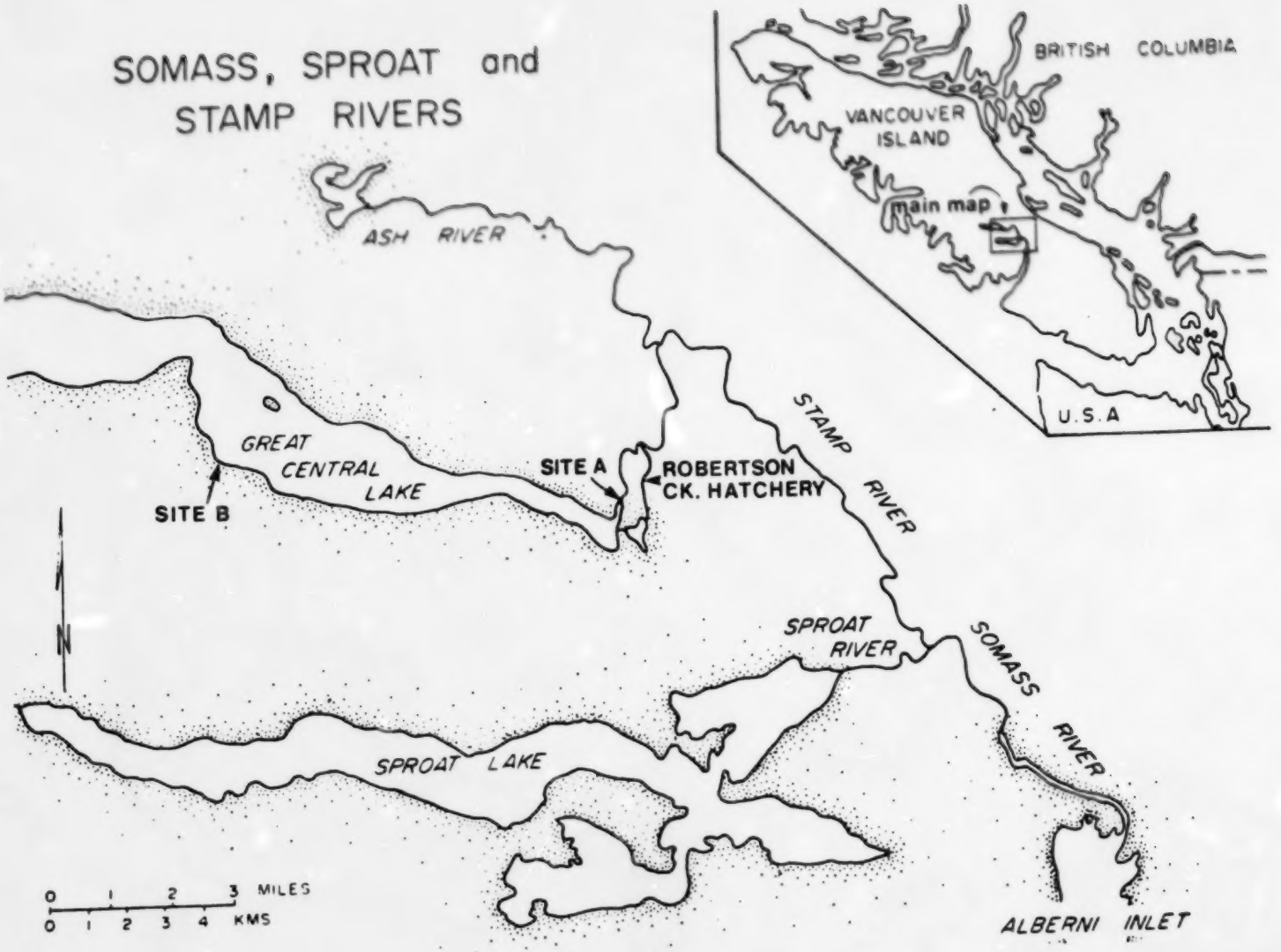

Fig. 1. The Somass watershed showing locations mentioned in text.

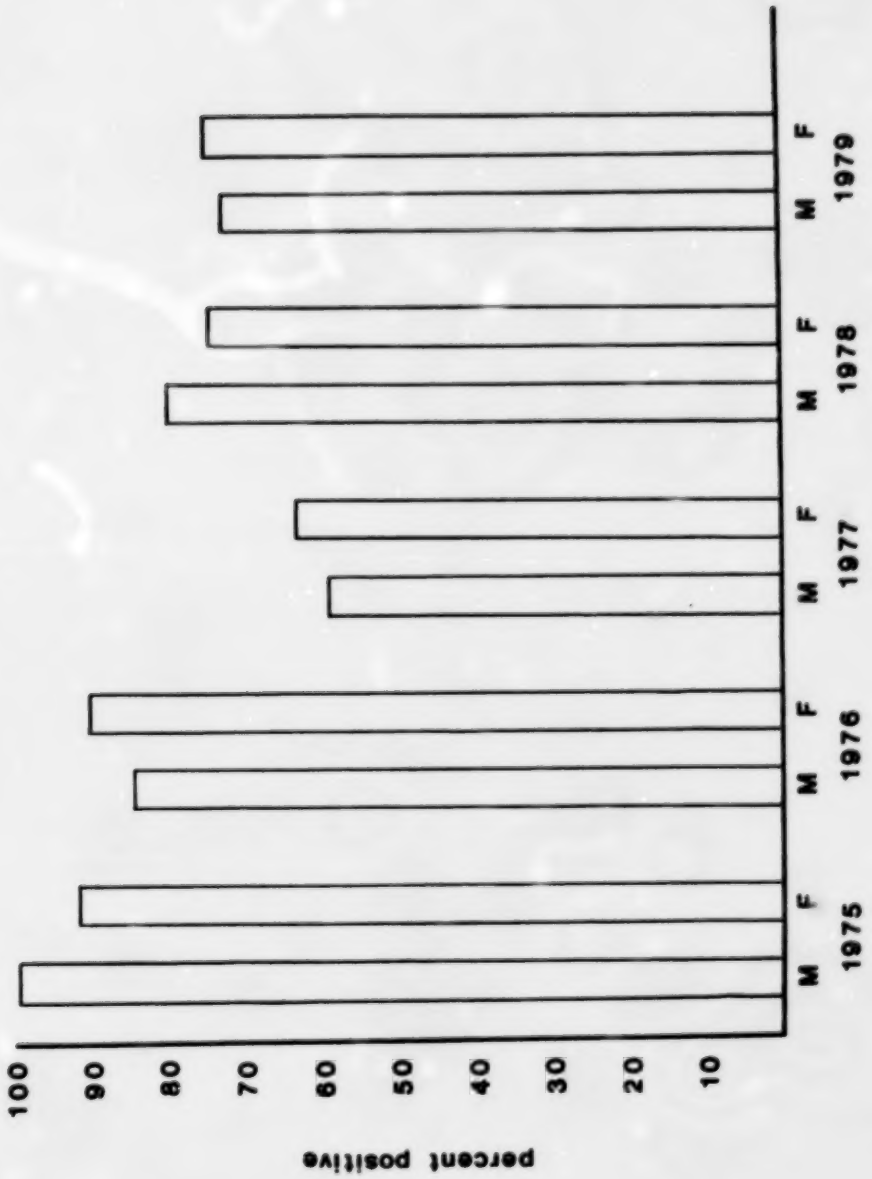

Fig. 2. Percent of post spawned male and female sockeye salmon positive each year for IHNV.

POOR

QUALITY

ORIGINAL